

FIG. \

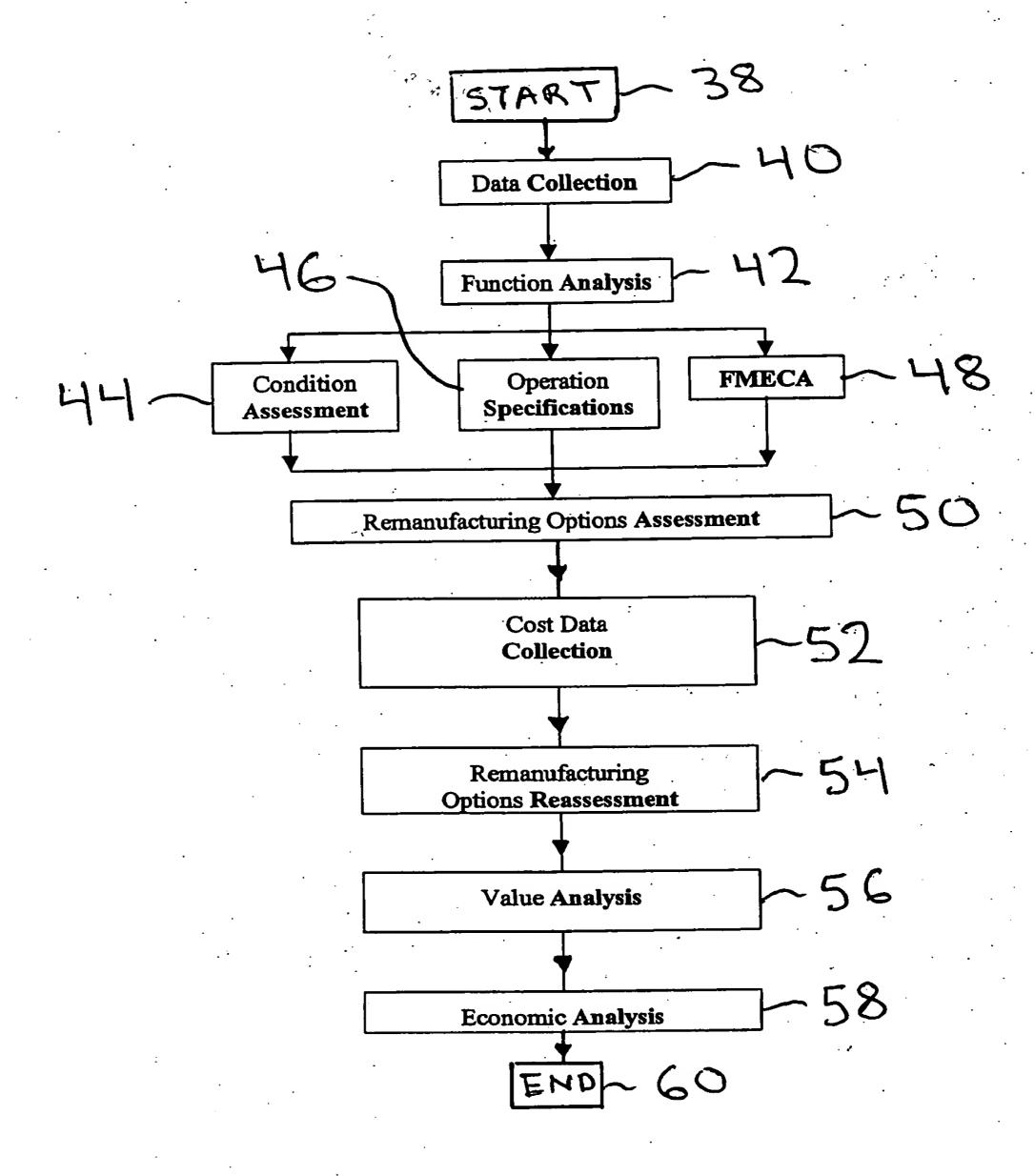
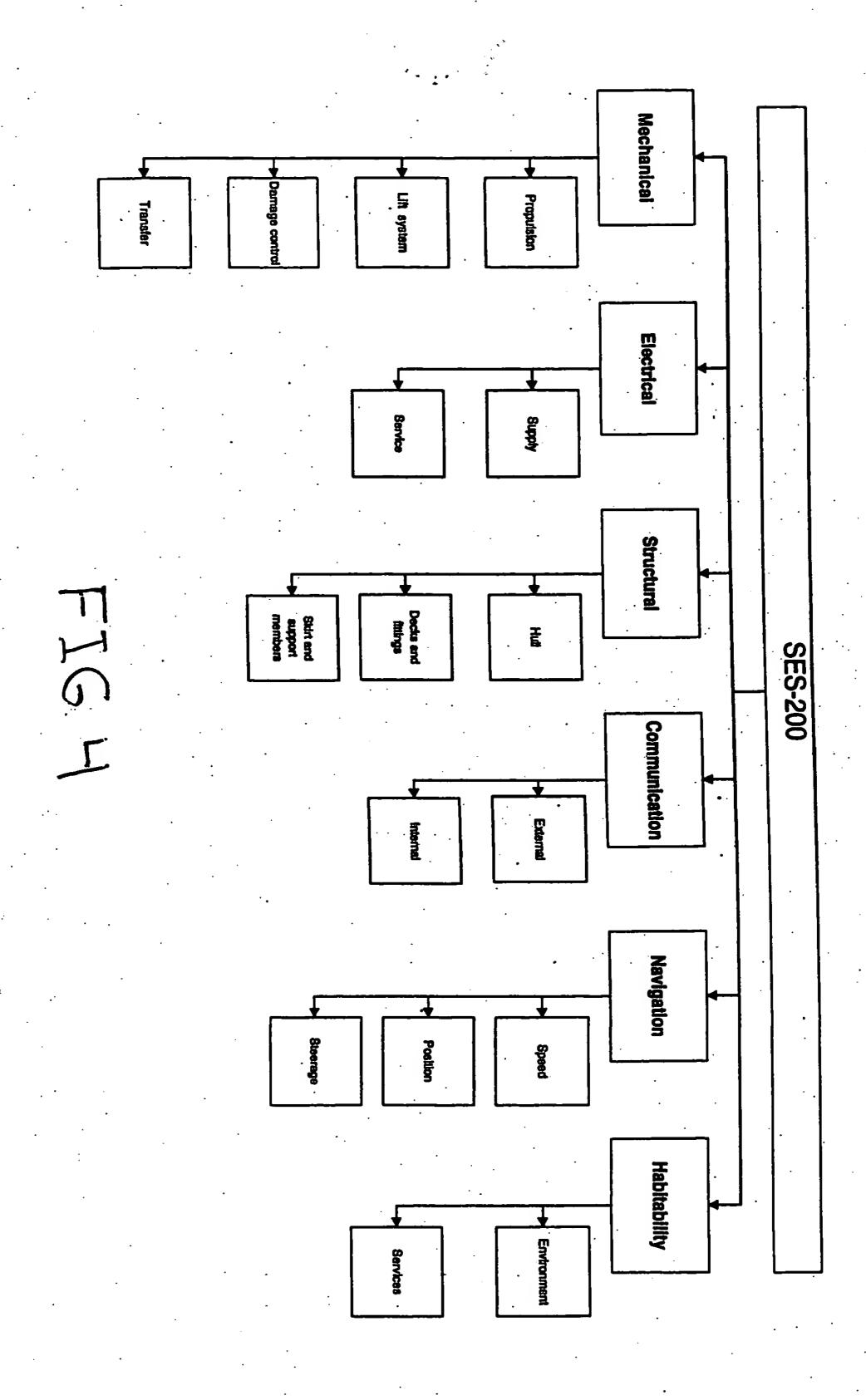


FIG. 2

### Data Availability Matrix

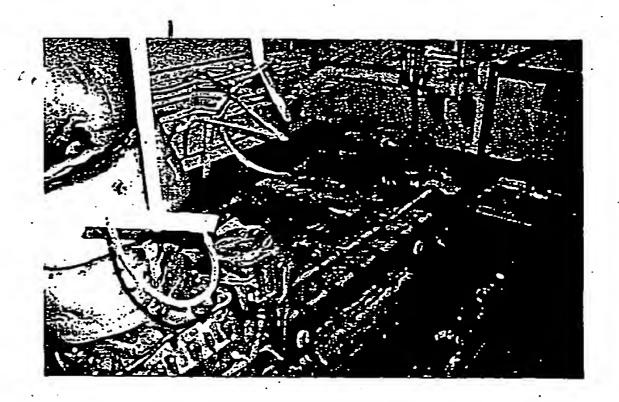
System Hierarchy	6		vings			F spides	766	n Out	(ಕ) ಭಂ೦	រតិកេច្ច	ी वंशक
	وما عبدالله	Manuals	System Map/Dra	-drietion -coffnillo	oem specs	Eustomer sp	Technology Upgrade	<b>Con</b> divon Assessme	New Cos	Dates Miss (Count)	Percent
ECHANICAL										1017	529
opulsion	T3		•							188	38
Drive MTU (port)					•				1		
Mounting		2	*	•	2	-	*	• -	Α.		
Remote control from the bridge			•	•	*			. •	_ A		<u> </u>
Enclosed operator space controls			•		-	<del></del>	·	•	A	••	
Local controls			•	•	-	1	•	•	٨		1
Exhaust		*	32.	•	-			•	A		1
Ignition			*	•				I	A		
Air intake	30	_ # _	*	•	*			•	A	•	
Reduction gearing	9.51		*	•	•			•	A		
Water seal	2-10	=	•	•				•_	A		
Drive shaft		=	•	•				•	Α		
Turbocharger				•				•	A		
Salt water cooling		_ #		•		L		•	A		
Fuel oil system				•	•			•	A		
Engine coolant pre-heater		•	•	•	•				A		
Drive MTU Internal air compressor				•				•	A		
Hydraulics			I .	•				•	_ A_		↓
Engine block components		2		•		·		•			
Drive MTU (starboard)					1		1	<u> </u>		L	┵
Mounting		<u> </u>		<b>↓ •</b>	*	*	<del>                                     </del>	•	<b></b>	<u> </u>	<del></del>
Remote control from the bridge		<del>.  </del>	•	•	1 · =	<del></del>	<del> </del>	<del>  •</del>	<b></b>	<del> </del>	<del>-</del> -
Enclosed operator space controls		╃——	<b>!</b>	1 •	<del>  *</del>	╀	<del>  </del>	<del>  •</del>	<del>  ^</del>	<del> </del>	┿
Local controls		-	•	<b>!</b>	*	<del></del>	+	•	<del>  ^</del>	<b>├</b> ──	┽—
Exhaust		<del></del>	*	+ =	*	<del>↓</del>	<del></del>	<u> </u>	^^	<del>                                     </del>	<del></del>
ignition		<del>                                     </del>	1 3	+ •	-	4		┵		<del> </del>	$\dashv$
Air intake		-	-	1 :	+ =		-}	•	<del>                                     </del>	+	+
Reduction gearing		+	-	+ •	•	<del> </del>	+	+ ÷	<b>^</b>	+	+
Water seal	<del></del>	2	-	•	<del>-</del>		+	+ :	<del>  ^</del> -	╁╌╌	<del></del>
Drive shaft	<del></del>	+-	┿	+ :	-	<del> </del>		+ ÷	<del>                                     </del>	╁	+
Turbocharger	<del></del>	<del> </del>   ×	+	+ =	+	<del></del>	+	+ -	1 2	<del> </del>	+
Salt water cooling		+	<del>-}</del>	+ ÷	-	<del>-</del>	<del>- </del>	+ -	1 2	<del>                                     </del>	<del></del>
Fuel oii system	<del></del> -	1 -	-	1 -	+ ÷	+	╅━╾	+ -	1 2	<del>                                     </del>	<del></del>
Engine coolant pre-heater		<del>- </del> -	<del>-                                     </del>	+ -	+ -	-	+	+ -	<del>  ^</del>	+	<del>-1.</del>
Drive MTU internal air compressor		+ -	+	+ ÷	1	<del>-  </del>	<del>- </del>	+÷	Ä	+	<del>                                      </del>
Hydrautics  Engine block components		-	+	+ -	+-	1	<del> </del>	<del>                                     </del>	A	1	$\neg$
KaMeWa jet (port)		<del>                                     </del>	+	╅	<del>- </del>	<del>- </del>	<del></del>	╌┼╌┷	<del>                                     </del>	1	1
Hydraulic powerpack	<del></del>	+	+ -	•	+	<del></del>	<del></del>	+-	A	1	
Hydraulic lines	<del>-   -</del>	+	+-	+	+	+	<del>-1</del> -	+ -	<del>                                     </del>		<del></del>
Electric heater		<del>-</del>	+ +	<del> </del>	+	<del> </del>	+	+ ÷	Ä	+	
Jet nozzle		+ =	+-	1 -	<del></del>		<del>                                     </del>	1 .	Ä	<del>                                     </del>	<del></del>
Jet nozzie  Jet pump	<del>-   -</del>	+ -	+ ÷	+ -	+-	+	<del></del>	1 •	Ä	+	
KaMeWa jet (starboard)		╌┼╌	╅╼	ᡟ᠊ᢆ	<del></del>		+	1		1	<del></del>
Hydraulic powerpack		+	+ •	+ -	<del></del>	<del>- </del>	+	1 •		1	<del> </del>
Hydraulic lines	<del></del>		<del>  •</del>	+ -	<del></del>	→		<del>-   -                                 </del>	$\rightarrow$		<del></del>

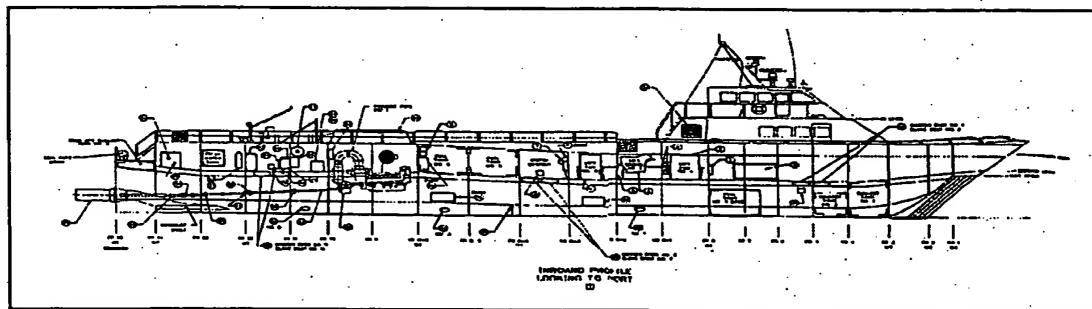


dary function  standar system  o main L/P air system  o main hydraulic system  o main hydraulic system		2.0			
Polytical control of the control of	System	Subsystem	Element		tion
New MITU (gold between the process of the process o					
Other MTU (band)   MAUCHING   Cours supplies to their before   Cours supplies to their cours   Cours supplies to their					
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Provide the control from the Media   Provide the control control control from the Media   Provide the control control control from the Media   Provide the control c			Mounting	Secure engine to ship framing to prevent movement and worsoon	
Exceled goesting gates controls   Provide to control of my provident control			Remote control from the bridge	Provide means to control engine from orings for residence.	
Court Controls   Provide teacher and the capture of single to entitle of single			Enclosed operator apace controls	Provide for centralized monitoring and control of energy	
Enhanst   Provide a test of the series of			Local controls	Provide rocal continuo de sea for estados de abio	
Transfer and the product reserve to the state of the st			Exhaust	Expel Culturation (descent to commercial com	
And into the month of the month	•		lgritton	Provide media for english de poetro	
Where some the coding the coding to the coding to explain a forther form engine to Kalevina weight purity (both of the chair form original to Kalevina weight purity (both of the chair form original to Kalevina weight purity (both of the chair form) for the coding to explain to ex			Air Intake	Transfer air to engine for continued in	
Transitier power from engine to Kakelwin weighted particle for the state			Reduction gearing	HOGICO KIMB to NAME and Indiana	
Convert of the south			Water 608l	Provides seei between drive triain eru tuuvissu	
Turbocharger   Turbocharger   Provide coding pip engine, arbuns and raduction greating   Provide coding pip engine, arbuns and raduction greating   Provide coding pip engine, arbuns and raduction greating   Provide build control arbundary   Provide control arbundary   Provide compressed at lor engine to arbundary   Provide compressed at lor engine stantage   Provide compressed   Provid			Orive shaft	Transfer power from engine to NaMewa waterest purity boots	
Sait water cooling  Foul of protein  Found wit'll (starboard)  Mounted  Found a control of anythin and protein but of control and protein and control of anythin and control of anythin and control of anythin and control of anythin anythin and control of anythin an			Turbocharger		Interfere with pall water confirm transfer evision
Fuel oil system  Fuel compressor  Fuel compressor  Fonds british control pre-heater  Fonds british compressor  Fonds british british compressor  Fonds compressor  Fonds british compressor  Fonds briti			Salt water cooling	exhinist.	The date with health because a suctem
Control production per leader   Heat empire and author actions the per leader			Enot of everlent		מונפנותכם אותו ותפו חו ונפנואום סלפים ו
Provide compressed at the engine book for MAJAN'N Informal ast compressed at the engine book for KAJAN'N Informal ast compressed			English modern overheater		Contract of Of I class of some and secular
Provide Indicating   Provide Indicating peaks			Dates LTT I Internal air comminessor	Provide compressed air for engine functions	Serve as surrectary squared to install or a special
Engine book components   Convert chemical energy (bus oil) to machanical energy			Lindowskips	Provide hydraufic pressure boost for KaMeWa hydraufic pack	Serve as auxuntary source to man regularity system.
Mounting  Mounting  Mounting  Recurse active to set services and services to starboard Kakkewa weaterfact purposes  Frontested operator spaces controls  Frontested operator spaces controls  Frontested or services transition to prevent control of engines burdons  Frontested operator spaces controls  Frontested or services transition to many factors of engines burdons  Frontested or services to starfor of ship  Frontested or services and provides to starfor of ship  Frontested or sortices or starfor of ship  Frontested means for endire starfor of ship  Frontested means for endire starfor of ship  Frontested or sortices or starfor of ship  Frontested or sortices or starfor or ship  Frontested confirm or sortices or starfor or ship  Frontested confirm or sortices or ship  Frontested confirm or sortices or ship  Frontested or sortices or starfor or ship  Frontest or sortices or sortices or ship  Frontested or sortices or sortices or ship  Frontested or ship  Frontested or ship  Frontested or ship  Frontested or ship  F			mydiaums F-1	Convert chancel energy (finel oil) to mechanical energy	
Mounting   Secure engine to ship framing to prevent movement and vibration for the bridge   Provide means to control engines			Crigina cours components	Deliver torque to starboard KaMeWa wateriet purro	
Recutation from the bridge Provide ansars to control engine from bridge for navigation purposes and process operator space controls Provide accounted of engine functions and control of engines brocked control of engines brocked and control of engines and control of engines brocked and control of engines and engin		DING MIC (SIGNORIU)	1 des enflete	Secure engine to ship framing to prevent movement and vibration	
Enclosed operator space controls  Involue  At intake  Reduction gashing  Provides and between other shall and buthered  Formal enclosed power from engine to KalkeWa welenfet purpo (starboard)  Formal enclosed power from engine to KalkeWa welenfet purpo (starboard)  Formal enclosed power from engine to KalkeWa welenfet purpo (starboard)  Formal enclosed controls and between other shall and buthered  Engine coolent pretern  Engine block components  Convert chemical pressure for waterior by weateriet  Attractic frests  Attractic frests  Attractic pressure from powerpack to weateriet  Attractic frests  Attractic frests  Attractic frests frests frests frests frests from powerpack to weateriet  Attractic frests  Attractic frests f			Spends control from the bridge	Provide means to control angine from bridge for navigation purposes	
Explaints of the control of engine brother of ship Explaints of the ship of the control of ship Explaints of the ship of			Coulour by constitute analysis contrata	Provide for centralized monitioning and control of engines	
Exhaust Entraust Provide means for entraust of still status of the control of the status of the control of the			I cont accorde	Provide local control of engine functions	
Ignition   Au triake     Ignition   Au triake     Authorise   Au triake     Authorise   Authorise   Authorise   Authorise   Authorise     Authorise   Authorise   Authorise   Authorise   Authorise     Authorise   Authorise   Authorise   Authorise   Authorise   Authorise     Authorise   Authorise   Authorise   Authorise   Authorise   Authorise   Authorise     Authorise   Authorise   Authorise   Authorise   Authorise   Authorise   Authorise     Authorise   Authorise   Authorise   Authorise   Authorise   Authorise   Authorise     Authorise   Authorise   Authorise   Authorise   Authorise   Authorise     Authorise   Authorise   Authorise   Authorise   Authorise   Authorise     Authorise   Authorise   Authorise   Authorise   Authorise   Authorise     Authorise   Authorise   Authorise   Authorise   Authorise   Authorise     Authorise   Authorise   Authorise   Authorise   Authorise   Authorise     Authorise   Authorise   Authorise   Authorise   Authorise   Authorise   Authorise     Authorise   Authorise   Authorise   Authorise   Authorise   Authorise   Authorise     Authorise   Authorise   Authorise   Authorise   Authorise   Authorise   Authorise   Authorise     Authorise   Authorise   Authorise   Authorise   Authorise   Authorise   Authorise     Authorise   Authorise   Authorise   Authorise   Authorise   Authorise   Authorise     Authorise   Authorise   Authorise   Authorise   Authorise   Authorise   Authorise     Authorise   Authorise   Authorise   Authorise   Authorise   Authorise     Authorise   Authorise   Authorise   Authorise   Authorise   Authorise     Authorise   Authorise   Authorise   Authorise   Authorise   Authorise     Authorise   Authorise   Authorise   Authorise   Authorise   Authorise     Authorise   Authorise   Authorise   Authorise   Authorise   Authorise     Authorise   Authorise   Authorise   Authorise   Authorise   Authorise     Authorise   Authorise   Authorise   Authorise   Authorise   Authorise     Authorise   Authorise   Authorise   Authorise   Authorise   Authorise     Authorise   Authorise			Exhaist	Expel combustion gases to exterior of ship	
Authors  Aut			the first teachers	Provide means for engine start-up	
Reducion gearing   Reduce RPMs to KNAW lets to prevent cavitation gearing   Provides seal between drive shall and buildhead   Provides seal between drive shall are cooling   Provides power from engine to KnAkaWa waterfalt pump (statioand)			At twenty	Transfer air to engine for combustion	
Visitor seat			O. c. when analog	Reduce RPMs to KMW lets to prevent cavitation	
Transfer power from engine to KaMeWa welerfet pump (stationary functionary fractionary fractionary fractionary fractionary fractionary functionary fractionary functionary fun	- 1		Market Politic	Provides seal between drive sheft and buildhead	
Euclid government engine power  Euclid gystem  Euclid gystem  Euclid gystem  Engine coolant pre-heater  Engine coolant pre-heater  Engine coolant pre-heater  Engine coolant pre-heater  Engine block components  Convert threads pressure for engine to propulsary long  Convert threads pressure from powerpack to waterfall  Hydraufig lines  Enciric heater  Engine block components  Engine block components  Convert threads pressure from powerpack to waterfall  Hydraufig lines  Enciric heater  Enciric heater  Encirc heater  Provide means of directing waterformy reservations  Hydraufic lines  Hydraufic pressure to provide propulsary forces  Convert threads pressure from powerpack to waterfet  Hydraufic lines  Hydraufic lines  Hydraufic lines  Hydraufic lines  Hydraufic lines  Hydraufic lines  Hydraufic pressure in provide propulsary forces  Convert threads pressure from powerpack to waterfet  Frovide means of directing waterflow for steerfroy/reversing  Hydraufic lines  Hydraufic pressure in provide provide provide provide provide provide means of directing waterflow for steerfroy/reversing  Hydraufic lines  Hydraufic lines  Hydraufic lines  Hydraufic pressure in the means of directing waterflow for steerfroy/reversing  Hydraufic lines  Hydraufic lines  Hydraufic lines  Hydraufic lines  Hydraufic pressure in the provide provide propulsary forces  Drovide means of directing waterflow for steerfroy/reversing  Hydraufic lines  Hydraufic			Weller Been	Transfer power from angine to KaldaWa wateriet pump [starboard]	
East water cooling  Fuel oil system  Fuel oil system  Fuel occurs pre-heater  Fuel occurs pre-heater  Fuel oil system  Fuel occurs pre-heater  Fuel oil to engine further expirer to prevent treating  Fuel occurs pre-heater			ANIMA BURIL	Ponet angle power	
Evel of eystem  Evel of eystem  Evel of eystem  Engine coolant pre-heater  Engine coolant pre-heater  Engine coolant pre-heater  Engine block components  Convert themsel energy (tuel oil) to mechanical energ			Lubocharger	ngine, exhaust	Interface with sail water cooling transfer evalent
Engine cootent pre-heater Provide compressor Provide compressor of for engine functions  Mydraulice Compensation Provide Involute the for engine functions  Mydraulic proverpack Convert chancel energy (fuel oil) to mechanical energy (converting fines)  Mydraulic proverpack Convert torque supplied by port office engine to propulsary long Convert torque supplied by port office engine to propulsary long Provide hydraulic pressure for wateries to wateries  Maintain embient temperature around jets  Electric heater Provide means of directing waterflow for steering/reversing Provide means of directing waterflow for steering/reversing Convert torque supplied by stbd other engine to propulsary forces (Convert torque supplied by stbd other engine to propulsary forces (Convert torque supplied by stbd other engine to propulsary forces (Convert torque supplied by stbd other engine to propulsary forces)  Maintain embers from powerpack to waterflow for steering/reversing (Convert torque constant engine to provide propulsary forces)  Maintain embers of directing waterflow for steering/reversing (Convert torque constant engine to provide propulsary forces)			Sait water county	Provide fuel oil to engine	Interface with fuel of transfer eyesem
Drive MTU Internal eff compressor  Drive MTU Internal eff compressor  Engine block components  Engine block components  Convert chemical energy (fuel oil) to mechanical energy  Convert torque supplied by port drive engine to propulsary loce  (Mydraulic glines  Energic heater  Waintain embient imperature around lets  Electric heater  Jet pump  Convert torque supplied by gord drive engine to propulsary loces  All nozzle  Jet pump  Convert torque supplied by gord drive engine to propulsary loces  Convert torque supplied by gord drive engine to propulsary loces  Convert torque supplied by gord drive engine to propulsary forces  Drived hydrautic lines  Electric heater  Jet pump  Convert torque supplied by gord drive engine to propulsary forces  Convert torque supplied by gord drive engine to propulsary forces  Maintain embient temperature around lets  Electric heater  Drived means of directing waterflow for steering/reversing  Drived means of directing waterflow for steering/reversing  Drived means of directing waterflow for steering/reversing			Fred on system	Heat engine coclart during extreme weather to prevent freezing	
Hydraulica Engine block components Convert chancel energy (fuel oil) to mechanical energy Engine block components Convert chancel energy (fuel oil) to mechanical energy Convert chancel energy (fuel oil) to mechanical energy Convert torque supplied by port office engine to propulsary long Hydraulic lines Jet nozzie Jet pump Hydraulic lines Jet nozzie Jet nozzie Jet master Hydraulic lines Jet master Hydraulic lines Jet mozzie Jet mestar  Maintain emblent temperature around jets Drowde propulsary forces Output seawater under gressure from powerpack to wateriet Hydraulic lines Jet mozzie J			No. 1671 Learned als companies	Provide compressed etr for engine functions	Serve as purchary source to main L/P art synam
Engine block components  Engine block components  Engine block components  Convert chemical energy (fuel oil) to mechanical energy foce  Convert through port of the engine to progressy foce  (Mortaulic lines  Jet nozzle  Jet nozzle  Hydraulic gowerpack  Maintain embient temperature around lets  Provide means of directing waterflow for steering/reversing  Provide means of directing waterflow for steering/reversing  Convert torque supplied by stid office engine to propulsary forces  Hydraulic lines  Hydraulic lines  Hydraulic lines  Maintain embient temperature eround lets  Transfer hydraulic pressure from powerpack to waterflet  Transfer hydraulic pressure from powerpack to waterflet  Transfer hydraulic pressure from powerpack to waterflet  Provide means of directing waterflow for steering/reversing  Maintain embient temperature eround lets  Maintain embient cressure to provide propulsary forces			LUTIVE RALL OF ENGINEER CAN CONTINUE SERVICE	Provide hydraulic pressure for engine functions	Serve as auditary source to main hydraung system
Engine book component  Engine book component  (tydraulic powerpack  (tydraulic lines  Electric heater  All nozzle  Act pump  Provide mains of directing waterflow for steering/reversing  Provide mains of directing waterflow for steering/reversing  Act pump  Provide mains of directing waterflow for steering/reversing  Act nozzle  Act pump  Provide mains of directing waterflow for propulsary forces  Convert torque supplied by stid other engine to provide propulsary force  Provide hydraulic pressure for waterfet manipulation  Provide hydraulic pressure from powerpack to waterfet  Hydraulic lines  Maintain amblent temperature around lets  Electric heater  Act nozzle  Act noz			Mydraulics	Course theory and the oil to mechanical energy	
Hydraulic powerpack  (Hydraulic lines  Electric heater  Let nozzie  Jet pump  Hydraulic powerpack  Hydraulic powerpack  Provide means of directing waterflow tor steering/reversing  Provide means of directing waterflow tor steering/reversing  Provide means of directing waterflow tor steering/reversing  Convert torque supplied by stbd drive engine to provide propulsary forces  Convert torque supplied by stbd drive engine to provide propulsary forces  Hydraulic powerpack  Transfer hydraulic pressure from powerpack to waterflet  Transfer hydraulic pressure from powerpack to waterflet  Hydraulic powerpack  Transfer hydraulic pressure from powerpack to waterflet  Hydraulic powerpack  Transfer hydraulic pressure from powerpack to waterflet  Hydraulic powerpack  Transfer hydraulic pressure from powerpack to waterflet  Hydraulic powerpack  Hydraulic powerpack  Transfer hydraulic pressure from powerpack to waterflet  Hydraulic powerpack  Hydraulic powerpack  Transfer hydraulic pressure from powerpack to waterflet  Hydraulic powerpack  Transfer hydraulic pressure from powerpack to waterflet  Hydraulic powerpack  Transfer hydraulic pressure from powerpack to waterflet  Hydraulic powerpack  Transfer hydraulic pressure from powerpack to waterflet  Hydraulic powerpack  Transfer hydraulic pressure from powerpack to waterflet			Engine block components	Control Country for the fact that and to produce the country force	
Hydraufic powerpack  (Hydraufic fines  Electric heater  Let pump  Jet pump  Hydraufic powerpack  Maintain ambient temperature around lets  Jet pump  Hydraufic powerpack  Hydraufic powerpack  Hydraufic powerpack  Transler hydraufic pressure from powerpack to waterfet		KaMeWa let (port)		Convert to the second for wateries for wateries from the second s	Serve as auxiliary source to main hydrautic system
Wetraulic lines   Transfer Involved in the Provider and in the State of S			Hydraulic powerpack	Provide lyuneum breakers from comments to write felt	
Electric heater Jet nozzle Jet nozzle Jet pump Jet nozzle Jet		•	(Hydrautic lines	( rensier mydrausc present a north pomy part	
Jet pump Jet pump Jet pump Jet pump Convert torque supplied by site drive engine to propulsery forces Hydrautic powerpack Transfer hydrautic pressure from powerpack to waterfet Transfer hydrautic pressure from powerpack to waterfet Maintain emblent temperature around lets Jet nozde Jet nozde Decine powerpack Jet nozde		•	Electric heater	Maintain annicin temperature at constitution	
Journal promises the pump Convert torque supplied by sibd drive engine to propultient force thydraulic powerpack to propultient force thydraulic pressure from powerpack to waterled Transfer hydraulic pressure from powerpack to waterled Maintain emblem temperature around lets the notate the propulsery forces the notate to provide propulsery forces to provide propulsery forces.			Jet nozzle	Provide means of directing wittename for scoring forms	
Hydrautic powerpack   Provide hydrautic pressure for wateriet manipulation			Jet oumo	Output seawater under pressure to provide propriessit recommendation	
Hydrautic powerpack		WellsWe let (stackness)		Convert tomus supplied by stod and engine to propress the	Gane as a reflery series to main hedge fits guideff
ines		The second secon	Hydrausic countries t	Provide hydrausic pressure for wateriet manipulation	
stor			Utadesido Bres	Transfer hydraudic pressure from powerpack to waterier	
			Darde bests	Maintain ambient temperature around jets	
				Provide means of directing waterflow for steering/leversing	
			Jet Tokas	Character under pressure to provide propulsary forces	

### Condition Assessm nt Data She t

	ESWBS:
	23310
	Function Group
	MECHANICAL
7. 7.	System
	Propulsion
	Sub-system
	Drive MTU
193	tem description
	Drive MTU port





Frame location:	The second second second second second	Ship location:		व्यक्तिक व नेन प्रति । विवसम्बद्धाः		
8-6 to 8-10		(11) Port	·			
Manufacturer:	Model #:	Part'#:	Serial #:			
мти	MTU 16V-396 TB94	N/A	559-0477			
Calada and Alexandra		<del></del>		<del></del>		

Condition:

Mounting, Remote control from the bridge, Enclosed operator space controls, Local controls, Exhaust, Ignition, Air intake, Reduction gearing, Water seal, Drive shaft, Turbocharger, Salt water cooling, Fuel oil system, Engine coolant pre-heater, Aux drive MTU air compressor, Hydraulics, Engine block components, \*Operating hours meter = 1930.68 hrs \*Turbo rusted \*Slight corrosion or other surface damage \*Air intakes missing \*Water buildup in drive shaft compartment \*Coolant manifold severely cracked \* Large coupling on drive shaft (FR 13) corroded \*Wt. = 6685 kg \*2560 kW \*2150 RPM \*Sea water cooling fitting to reduction gear cracked \*See detailed report from Florida Detroit Diesel-MTU for more information

Condition Assessment Matrix

System Higher Execution gentry gates control from the bridge Enciosed operator space control from the bridge Encion gentry from the bridge from the bridge Encion gentry from the bridge
VS(em Hierarchy Dive MTU (port)    Physical Condition   Physical Physica
VSICH FIELZICIN  Mounting  Fuel of system  Entities docart space controls  Fuel of system  Entitles docart pre-heater  Fuel of system  Fuel of
VS(em Hierard Control of the bridge Enclosed Operator from the bridge Enclosed operator from the bridge Enclosed operator from the bridge Enclosed operator general Trustes Enclosed operator from the bridge Enclosed operator general Trustes Enclosed operator general Trustes Enclosed operator general Trustes Enclosed operator general Trustes
Stein Flerzich   Physical Condition   Physical Condition
VS (em High Herard)  Wouting  Full coll control from the bridge  Exhaust  Exhaust  Exhaust  Exhaust  Turbocharger  Salt water sooling  Full coll system  Engine coolant pre-beater  Drive strate  Full coll system  Full coll system  Full coll control from the bridge  Full coll control from the brid
VSTET HETATION    Physical Consists   Physical
VS CEM HIETOTOM  Ion  Dive MTU (part)  Mounting  Fruic of system  Enclosed operator space controls  Fruic of system  Engine collect from the bridge  Fruic of system  Engine collect pre-heater  Salt water colling  Fruic of system  Engine block components  Orive MTU (starboard)  Mounting  Remote control from the bridge  Fruic oil system  Engine block components  Orive MTU (starboard)  Mounting  Remote control from the bridge  Engine block components  Orive MTU (starboard)  Mounting  Remote control from the bridge  Engine block components  Drive MTU (starboard)  Mounting  Remote control from the bridge  Enclosed operator space controls  Enclosed operator space controls  Engine  Remote control from the bridge  Enclosed operator space controls  Remote control from the bridge  Enclosed operator space controls  Remote control from the bridge  Enclosed operator space controls  Remote control from the bridge  Enclosed operator space controls  Remote control from the bridge  Enclosed operator space controls  Remote control from the bridge  Enclosed operator space controls  Remote control from the bridge  Enclosed operator space controls  Remote control from the bridge  Enclosed operator space controls  Remote control from the bridge  Enclosed operator space controls  Remote control from the bridge  Enclosed operator space controls  Remote control from the bridge  Enclosed operator space controls  Remote control from the bridge  Enclosed operator space controls  Remote control from the bridge  Enclosed operator space controls  Remote control from the bridge  From the control from the bridge  Remote control from the bridge  From the control from the bridge  Remote control from the bridge  From the control from the bridge
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VS (e.m. Filerarchy  Nounting  Freionsed operator space controls  Freionsed operator s
VSTEIN FIELZICIV  Brive MTU (port) Mounting Remote control from the bridge Enclosed operator space controls Local confrols Exhaust Ignition Air intake Reduction gearing Water seal Drive shaft Turbocharger Salt water cooling Fuel oil system Engine coolant pre-heater Drive MTU (starboard) Mounting Fuel oil system Engine coolant from the bridge Engine coolant gree-heater Drive MTU (starboard) Mounting Remote control from the bridge Engine controls Exhaust Cocal controls Exhaust Local controls Exhaust Ignition Air intake
VSICIN FIELD FOR CONTROL Seized Mounting  Reduction gearing  Water seal  Drive MTU (starboard)  Water seal  Drive MTU (starboard)  Water seal  Drive MTU (starboard)  Mounting  Finclosed operator space controls  Exhaust  Local controls  Exhaust  Local controls  Exhaust  Local controls  Exhaust  Junition  Aff Intake  Finclosed operator space controls  Exhaust  Local control from the bridge  Enclosed operator space controls  Exhaust  Local controls  Exhaust  Local control from the bridge  Enclosed operator space controls  Exhaust  Finclosed operator space controls  Finc
VSICIN FICTORY  Seized  Mounting  Fuel oil system  Engine block components  Ali hitake  English of the bridge  E
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VSTERN HIERATCHY  Johns MTU (port)  Mounting  Remote control from the bridge Enclosed operator space controls Local controls Enclosed operator space controls Local controls Enclosed operator Air intake Reduction gearing Water seal Drive shaft Turbocharger Salt water colling Fuel oil system Engine coolant pre-heater Drive MTU internal air compressor Hydraulics Engine block components Drive MTU internal air compressor Hydraulics Engine coolant pre-heater Drive MTU internal air compressor Hydraulics Engine coolant pre-heater Cooling Fuel oil system Engine coolant pre-heater Salt water colling Fuel oil system Engine coolant pre-heater Salt water colling Fuel oil system Engine coolant pre-heater Salt water colling Fuel oil system Engine coolant pre-heater Salt water colling Fuel oil system Engine coolant pre-heater Salt water colling Fuel oil system Engine coolant pre-heater Salt water colling Fuel oil system Engine coolant pre-heater Salt water colling Fuel oil system Engine coolant pre-heater Salt water colling Fuel oil system Engine coolant pre-heater Salt water colling Fuel oil system Engine coolant pre-heater Salt water colling Fuel oil system Engine coolant pre-heater Salt water colling Fuel oil system Engine coolant pre-heater Salt water colling Fuel oil system Engine coolant pre-heater Salt water colling Fuel oil system Fuel oil system Engine colling Fuel oil system Fuel oil syste
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FIG. 7

# Operation Specification Matrix

System Subsystem	Floment	Operational Specification
MECHANICAL		
Propulsion  Drive MTU (port)		MTU 16V396TB94, Liquid cooled, Four-stroke diesel engine, Antl-clockwise direction of rotation, High Performance Rating Class 10S- Fast Vessels, Certification w/classifiable power (0.809 x rated power) from all leading classification societies, Fuel Power Stop kW (mhp): 2560 (3482), Engine output: 3200 bhp each, Speed RPM; 2150, Gearbox Model: BW 755 Free-standing, Transmission Ratio: 2.33: 1, Bore/Stroke mm (in.): 165/185 (6.5/7.3), Total Displacement L (in*): 63.4 (3866), Intake air temp. 25°C / Sea water temp.
	Mounting	Flanges and conical rubber elements
	Remote control from the bridge	
	Enclosed operator space controls	Sheet-steel housing w/resillent mounts
	Local controls	Speed, Temperatures (coolant, raw water, charge air, exhaust before turbine), Pressure (block, non-return valves, coolant & raw water lines), Fluid levels
	Exhaust	Exhaust gas turbo-charging
	notition.	Flectic starter
	Air intake	Combustion air system- intake filter strainer w/attaching hardware
	Reduction gearing	Valve gear and gear train, Behr BW755, Serial #219 (STRBD) #220 (PORT), Ratio 2.33:1

F16.00

# Failure Modes, Effects, and Criticality Analysis (FMECA)

System	≛ubsystem	Function	Failure Modes	Cause
<u>ar an </u>				
	Drive MTU	Deliver torque to KaMeWa waterjet		
		Secure engine to ship framing to	Mounting fails	Wear
·		prevent movement and vibration	MOCH IN 19 10 10	Corresion
				Manufacturer's defect
l		Provide means to control engine from	n a balden felle	Power Fallure
		bridge for navigation purposes	Remote control from the bridge fails	Circuit Interruption
	·			
•		Provide for centralized monitoring and control of engines	Enclosed operator space controls fall	Power Feiture
				Circuit Interruption
	• . •	Provide local control of engine functions	Local controls fall	Power Faiture
				Circuit Interruption
		Expel combustion gases to exterior of ship	Exhaust fails	Obstruction
		<b></b>		Faulty Seal
				Damaged Piping
			ignition fails	Air System Failure
		Provide means for engine start-up		Power Failure
•		·		Circuit Interruption
			Air Intake falls	Obstruction
		Transfer air to engine for combustion Reduce RPMs to KMW jets to preven	<u> </u>	Wear
		cavitation		Correcion
•				Insufficient Lubrication
	·			Manufacturer's defect
		Transfer power from engine to	Drive shaft fails	Weer
	· I	KaMeWa waterjel pump (port)	Dave shall take	Corrosion
			<u> </u>	Load .
			· · · · · · · · · · · · · · · · · · ·	Manufacturer's defec
	, .	Provides seal between drive shaft a buildhead	Water Seal leaks	Wear
ł		,		Manufacturer's defec
		Boost engine power	Turbocharger falls	Wear
				Corrosion
				Manufacturer's defe
		Provide cooling to engine, exhaust	Salt water cooling fails	Wear
		reduction gearing		Corresion
		· · · · · · · · · · · · · · · · · · ·		Manufacturer's defe
		Heat engine coolant during extrem	Nim HotStart Engine Coolant Heater falls	Power Failure
1		weather to prevent freezing	Mill Polotoi Englis social i issue	Electrical grounding

# Failure Mod s, Effects, and Criticality Analysis (FMECA)

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consistent regions informational control of the con							
Compromised propulation to single control from holdge control from	Excessive engine vibration/movement	Engine fallure/drive train damage	Compromised propulsion to ship	Auditio	7	3	21
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tractify to remote yourists argines  reactify to remote yourists argines  Consideral Pellung  Less of number control of engine control of engine (nom bidge)  Compromised propulation to aftip  Construction t	Excessive engine vibration/movement	Engine tallure/tirive train derrage	Compromised propulsion to ship	Auditio	7	2	14
ses of engine control from bridge  Loss of namotes control of engine (characterists of engine (from bridge)  Loss of namotes control of engine (from bridge)  Comportised preputation to strip  Comportised preputation to strip  Comportised preputation to strip  Comportised preputation to strip  Comportised preputation of strip  Audition  Runeway engine  Catastrophic damage to engine-potential tisse of 8s and Audition  Runeway engine  Catastrophic damage to engine-potential tisse of 8s and Audition  Runeway engine  Catastrophic damage to engine-potential tisse of 8s and Audition  Runeway engine  Catastrophic damage to engine-potential tisse of 8s and Audition  Runeway engine  Catastrophic damage to engine-potential tisse of 8s and Audition  Audition	Loss of engine control from bridge		inability to remotely control engines	Operational Febure	4	3	12
yestem fails to response or tresponse for the policy of the SCF   Constituted Profiles   Co	Loss of engine control from bridge		inability to remotely control engines	Operational Failure	4	5	20
Joseph Maria Bits in respond to control them ECST.  Control load of anythe control  Rameway engine  Catastrophic derange to engine-potential load of file  Auditial  Rameway engine  Catastrophic derange to engine-potential load of file  Auditial  Rameway engine  Catastrophic derange to engine-potential load of file  Auditial  Audital  Auditial  Auditial  Auditial  Auditial  Auditial  Auditial	System falls to respond to controls from ECR	Loss of remote control of engine (from bridge)	Compromised proputation to ship	Operational Palure	6	3	18
Compromised propulation to ship  Constructive shart  Compromised propulation to ship  Visuall  Constructive shart  Constructive shart  Constructive shart  Constructive shart  Constructive shart  Constructive shart  Constructive to ship  Visuall  Constructive shart  Constructive shart  Constructive shart  Constructive shart  Constructive shart  Co	System falls to respond to controls from ECR .	Loss of remote control of engine (from bridge)	Compromised propulsion to ship	Operational Palure	8	3	18
State regime control engine control in regime co	Total loss of engine control	Runaway engine	Catastrophic damage to engine/potential loss of IRe	. Audible	9	1	9
Solution processes processes.  All causity in aftire componitiend  Health hassard  Gaging/Neural  All causity in aftire componitiend  Health hassard  Compromised propulation to aftire  No power transmission to KalakeWa  Compromised propulation to aftire  Compromised propulation to aftire  Visual  All 2 50  Compromised propulation to aftire  Compromised propulation to aftire  Visual  All 2 50  Compromised propulation to aftire  Visual  All 3 50  Compromised propulation to aftire  Visual  All 2 50  Compromised propulation to aftire  Visual  All 3 50  Compromised propulation to aftire  Visual  All 4 50  Compromised propulation to aftire  Visual  All 4 50  Compromised propulation to aftire  Visual  All 5 50  Compromised propulation to aft	Total loss of engine control	Runaway engine	Catastrophic demage to engine/potential loss of life	Audible	9	•	•
Final Borne of the state of the	Excessive bedpressure	Stall engine	Compromised propulsion to ship	Geging	•	7	•
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Engine will not alast  Compromised propulation to ship  Visual 6 4 9 8 6 6 4 9 8 6 6 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9	Exhaust blow-by	Air quality in ship compromised	Health Ingert	Geging/Visual	•	4	∞.
Engine will not start  Compromised propulation to strip  Visual  6 4 8  6 64 9  6 6 64 9  6 6 6 9  6 6 9 9  6 6 6 9  6 6 9 9  6 6 6 9 9  6 6 6 9 9  6 6 6 9 9  6 6 6 9 9  6 6 9 9  6 6 9 9  6 6 9 9  6 6 9 9  6 6 9 9  6 6 9 9  6 6 9 9  6 9  6 9 9  6 9	Engine will not start		Compromised propulation to ship	Operational Pallure	7	4	28
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Inability to preheat coolant at start-up Potential stressing Capture Coolant at start-up Potential stressing Capture C	Engine/Gearbox/Exhaust Overheats	Engine failure	Compromised propulsion to ship	Geging	4	<u> </u>	2 12
Inability to preheat coolant at start-up Potential thermal stressing Engine failure/thermal cracking of engine block Geging 7 3 3	Inability to preheat coolant at start-up	Potential thermal stressing	Engine tallura/thermal cracking of engine block	Geging	1	<u>'   '</u>	3 21
	inability to preheat coolent at start-up	Potential thermal stressing	Engine talture/thermal cracking of engine block	Geging	<u>'</u>	<u>'                                    </u>	3 21

emanufacturing Options Criteria

	Condition			5	Criticality	Spe	Operation Specifications			Reman	Remanufacturing Options	Options	
Good Fair	Fair	Poor		Critical	Non- Critical	Mæts	Doesn't Meet		Modify	Restore	Reuse	Replace	Remove
7				٨		>		<u> </u>		7	7		
-				^			7		7	7	7		>
7					٨	>					>		
-					^		٨	L	7		7		>
	٨			٨		7				>	7	>	
	٧		+	٨		+	7		>	>		>	7
	٠ ٧				۸ .	>				7	7		
	٧				٨		7		7	7	7		7
		٨		٨		>		_				>	
		٨		٨			7	_				>	7
		٨			٨	>		<u> </u>				>	
		٨			7		~					7	>

F16. 10

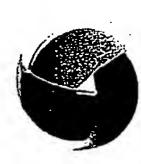
## Remanufacturing Options Matrix

Leg nd:	Identifies option as a "best" possible choice in the remanufacturing Identifies option as a possible choice in the remanufacturing proce			 } !	
	Identifies option as not feasible in the remanufacturing process			i	
System	Sub- system Element	Modify	Restore Reuse	Replace	Remove
Propulsion				·	
	Drive MTU (port)				
	Mounting				
	Remote control from the bridge				:
	Enclosed operator space controls				
	Local controls			-	
	Exhaust				
	Ignition	S. P.	<b>美</b>	·	
	Air intake				
	Reduction gearing .				
	Water seal				
	Drive shaft				
	Turbocharger				
	Salt water cooling				
	Fuel oil system				
	Engine coolant pre-heater				
	Drive MTU internal air compressor				
	Hydraulics	7.1	1290 CS		
	Engine block components	11		:	
	Drive MTU (starboard)	T.U	·		
	Mounting .				
	Remote control from the bridge				
	Enclosed operator space controls	- 7			
	Local controls				
	Exhaust				
	Ignition				

FIG.11

S Conversion Project Info-Base - [SES	Conversion Project Info-Bas	e		221012
Plan Ech / Year Dissert - Pormet Bacords C	A CONTRACTOR OF THE PARTY OF TH			Charles of the last of the las
	Andrew State William St		No service and the service and	
ns - Reports - Administrative	ALTECTION OF THE PARTY OF THE P			The second second
SES 200	▲ Main engine #2 (	port)	ID:1405; go to Techn	HEAL FOREIGNIA'S CONT.
HECHANICAL	Paragraph Control	tions Summary Final Notes		
Propulsion	A RESERVE AND THE PARTY OF THE		74-201-12-201-201-201-201-201-201-201-201-	
d—-\$ Main engine €2 (pa				
\$ Remote contri			DISCUSSION SERVICE	
Enclosed ope	Monufacturer	Part Number		Reman Definitions
Local controls	The state of the s	the street of th	59-0477	
Exhaust	Model			
Ightton	Option Set II	chnical Economic	Notes	Heli
Air Intake  Turbocharger	Modify dim	practical: Imprectical		
Satt water coo	Remove	practical Impractical •		
Fuel oil system	and the first of the same and the property bearings and	ossible -		1
S Engine coote	14	Best -		2
Internal str co		practical   Impractical		
Engine block	THE REPORT OF THE PARTY OF THE	we are the first the second of	e en en en 1786 for de la Constantion de la Cons	
B S Main engine #1(sth		1 (all prices are based on qua	ntity one)	
Remote contr			Cord act Name	Frill Wasinger
\$. Enclosed ope	11 11 11 11 11 11 11 11 11 11 11 11 11	Company Name: MTU Friedrichshalen w/L		
Local controls	Reptace	Address 1 1401 H. Street, N.W., Suk	9 700 Rulerted By:	
- Exhaust	Option Cost	Address2	Phone Number	(+1-202) 414 6778
Ignition	\$647,000.00	CRY WASHINGTON	Fax Manher	(+1-20Z)4146773
Air Intake	Installation Cost	Slate DC Zp 20005	Email	phil_wasinger@daimie
Turbocharge		Sies pr		A SOME OF THE PARTY OF THE PART
Satt water co		Replacement Part#	Secret Belleville	Request for Quotation
Engine cools	the late of the second	- Machage Linear Learns	1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1	
internal air co		Other Information	esponsible SGV	Option ED
Engine block	Uninstall Cost	The price muste is per engine and included	controls, monitoring system	is and engine containt pre
S Kamewa jet (port)	\$5,000.00	nester (\$607,000). Remove the current ali	injet housing and move to s	de of hull or area behind
S Kamawa jai (atbd)	Salvage Value .	pilot house (\$40,000).		
\$ Reduction Gears (	1 1	· []		
S Water seal (port)	Quote Type			
\$ Driveshall (port)		r:{{}		
<u> </u>	OBA	i i i	•.	
<del></del>	Record: 14 4	1 +   >1   >4   d 2		
		• • • • • • • • • • • • • • • • • • • •		•

F1G. 12



# SES-200 Conversion Project Cost Availability Matrix

Carlotte of the second						-
Steens of data	Sand Specific					
Data Missing (1) (1) (1)						
Vain Contact	SGV	SGV SGV SGV SGV	AJM SGV SGV	SGV	SGV SGV	SGV
						4
	(1) (1) (1) (1) (1) (1) (1) (1) (1) (1)	Neediffermayal(costate with the Setting of Lands Brown Gentling on James Brown Gentling other costs		Waltington Frank 25 55 10 10 10 10 10 10 10 10 10 10 10 10 10		
eulste		State	Karana Karana Karana	K. 18.55.		
	AND WATER	Neediffemayal(costilities) Getting of James Brown Getting on James Brown	Done ( ) ( ) ( ) ( ) ( ) ( ) ( ) ( ) ( ) (	Walting on Frank 25 5 20 Walting on Frank	Waiting on Frank Waiting ion Frank Waiting (on Fak	Dönek attack et statistic
	PER Done Went	Cetting Done Done Waltin	* ::   Done	est Walth	CAN Waltin	Oone
Revise- Modify Remove						
Rework-Restore				(A)		調器器調
Clean- Reuse		M M M O M		(1) e (1)		
Mew-Replace_	A MORE					W WENT
					K,clean,p	S. Karak
	SELATATION ON	6 Oberator Space (Control state of the Space			Stringera Frames, Outlets) - drydock clean paint etc. (WTD's)	光光经验
	AND A CHANGA AND AND AND AND AND AND AND AND AND AN	<b>1)</b>		atoricontrol Panel & First		
	(2)	ionspace	Fowerpacks (4) s port s starboard (3) Generators (2)	ntrol Pan	s, Frame	sinks, piping, etc.
S C				7 6		
6	S E	Hittengines Englose KaMewa Waterjets MTU Lift Engines (2 Firemain Pumps (2 Halon System	Kamewa Hydraulio L/P Air Compresso L/P Air Compresso Säachests (6) Ship Service Diese	Wirting:	Hull (Shell Plating) Weather Deck Water Tight Doors	atrines 4,
	Drive MT	KaMeWa Waterjets MTU Lift Engines (2 Firemain Pumps (2 Halon System	Kamewa Hydraulic  L/P Air Compresso  Seachests (6) Ship Service Diese	Electrical Wirting (	Hull (Shell Plating) Weather Deck Water Tight Doors	Heads (latrines
	<b>3</b>					

- = Data not required
  - = Data Collected
- Need more information to proceedAble to look for Reman costs
- = In the process of getting cost information = Need the Removal Cost 38.00
  - = Done

Option Recovery	Economic	Not see Ref	
Modriy Impractical	Impractical 3		
Remove Impractice	Impractical 🖹		_
Replace & Possible	Possible		_
Restore	Best 🗵	2	_
Reuse Impractica	Impractical *		<b>13.5</b>

# F16:14A

Online	Recovery	Economic		Notes - Notes	Ref
Modify		Impractical			
Remove		Impractical	٠		
Replace	Best	Best	₩.	Dependent on recovery option for main drive MTU	226
Restore	Possible	Possible	•		270
Reuse	Impractical	Impractical	<b>V</b>		

# FIG. 14B

Scenario #1:	REPLACE MTU engine		REPLACE Kim Hotstart w/ internal unit
	RESTORE MTU engine	REQUIRES	REPLACE Kim Hotstart w/ new unit
	RESTORE MTU engine		RESTORE Kim Hotstart

FIG. 14C

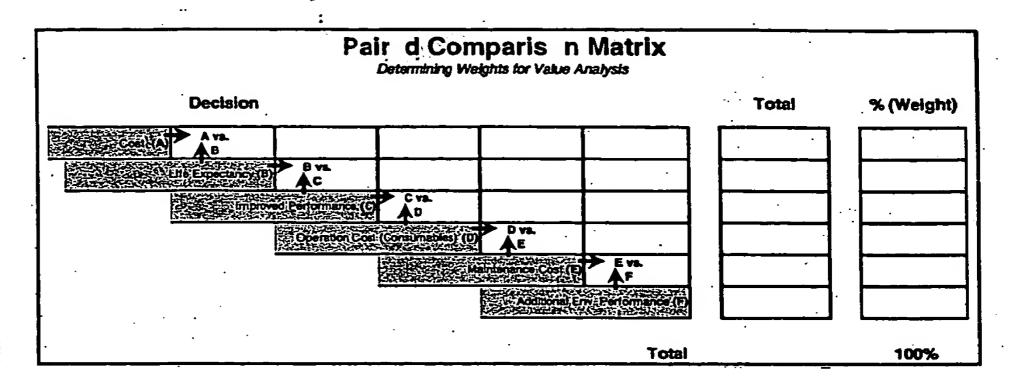


FIG. 15

	•	Pai	red Comp Determining Wel	arison Ma ghts for Value An	atrix <sub>Blysis</sub>	• ,	
	Decision		•	•		Total	% (Weight).
Cost (A)	В	С	Α	Α .	Α	3	20%
	life Expectancy(B)	В	В	В	В	5	33%
	Improve	d Performance(C)	С	С	С	4	27%
1		Operation Cost	(Consumables[D]	D	D	2	13%
	•		Mai	ntenance Cos(E)	E	1	7%
	•	. •		Additional Env	Performance (F)	· 0	0%
		•			Total	15	100%

FIG. 16

Replace Reman Option	% (Weight)	Ratings
Cost (A)	20%	4
Life Expectancy (B)	33%	4
Improved Performance (C)	27%	4
Operation Cost (Consumables) (D)	13%	3
Maintenance Cost (E)	7%	4
Additional Env. Performance (F)	0%	3

FIG. 17A

Restore Reman Option	% (Weight)	Ratings
Cost (A)	20%	3
Life Expectancy (B)	33%	. 4
Improved Performance (C)	27%	3
Operation Cost (Consumables) (D)	13%	3
Maintenance Cost (E)	7%	4
Additional Env. Performance (F)	0%	3

F16. 17B

Replace Reman Option	% (Weight)	Ratings	Score
Cost (A)	20%	4	0.80
Life Expectancy (B)	33%	4	1.33
Improved Performance (C)	27%	4	1.07
Operation Cost (Consumables) (D)	13%	3	0.40
Maintenance Cost (E)	7%	4	0.27
Additional Env. Performance (F)	0%	3	0.00

Total

3.87

FIG. 18A

Restore Reman Option	% (Weight)	Ratings	Score
Cost (A)	20%	3	0.60
Life Expectancy (B)	33%	4	1.33
Improved Performance (C)	27%	3	0.80
Operation Cost (Consumables) (D)	13%	3	0.40
Maintenance Cost (E)	7%	4	0.27
Additional Env. Performance (F)	0%	3	0.00

Total

3.40

	Determ	Pai ining Weights	red Com for Value Anal	parison Ma Sysis - Main MTU	atrix / Engine/Kim Ho	tstart Scenario	
	Decision		•			Total	% (Weight)
Cost (A)	В	С	A	Α	Α	3	20%
	Life Expectancy(B)	В	В	В	B	5	33%
	Improve	d Performance(C)	, С	С	С	. 4	27%
	_	Operation Cost	(Consumables[D)	D	D	2	13%
	•		M	Intenence Cost(E)	E	.1	7%
	•	•		Additional Env.	Performance(F)	0	0%
•			·		Total	15	100%

F16. 19

Scenario #1	% (Weight)	Ratings	Score
Cost (A)	20%	3 -	0.60
Life Expectancy (B)	33%	5	1.67
Improved Performance (C)	27%	4	1.07
Operation Cost (Consumables) (D)	13%	4	0.53
Maintenance Cost (E)	7%	3 .	0.20
Additional Env. Performance (F)	0%	4	0.00

Total

4.07

F1G. 20A

Scenario #2	% (Weight)	Ratings	Score
Cost (A)	20%	4	0.80
Life Expectancy (B)	33%	4	1.33
Improved Performance (C)	27%	3	0.80
Operation Cost (Consumables) (D)	13%	3	0.40
Maintenance Cost (E)	. 7%	3	0.20
Additional Env. Performance (F)	0%	3	0.00

Total

3.53

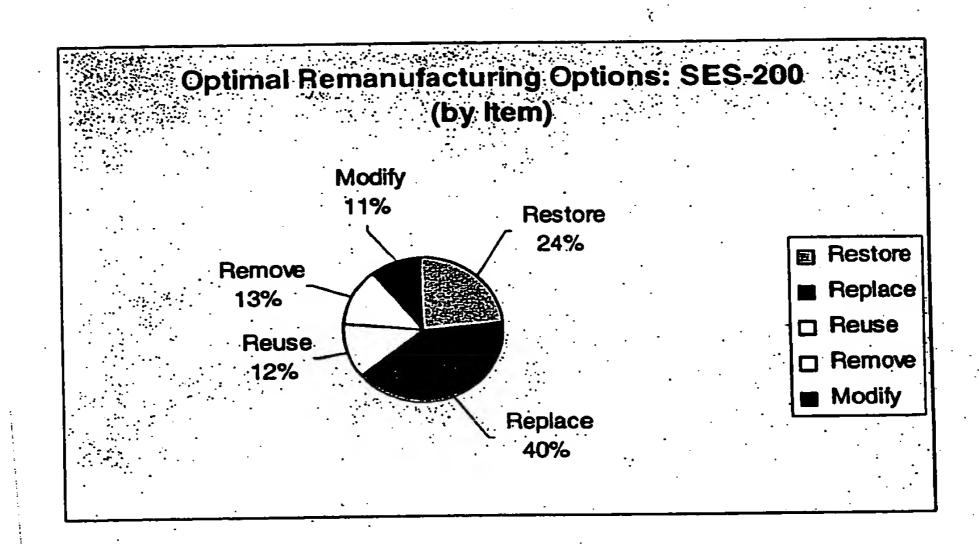
FIG. 20-B

Scenario #3	% (Weight)	Ratings	Score
Cost (A)	20%	4	0.80
Life Expectancy (B)	33%	4	1.33
Improved Performance (C)	27%	3	0.80
Operation Cost (Consumables) (D)	13%	3	0.40
Maintenance Cost (E)	7%	3	0.20
Additional Env. Performance (F)	0%	3	0.00

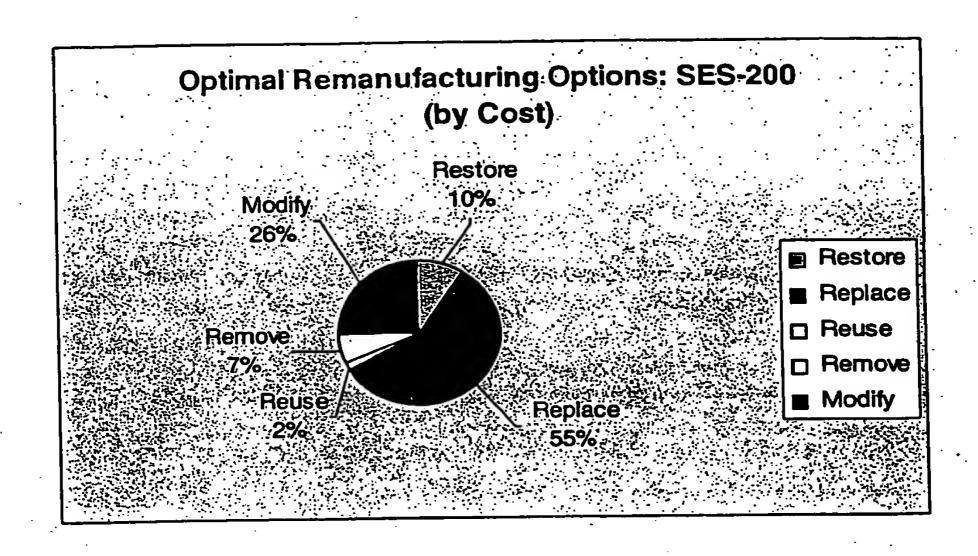
Total

3.53

FIG. 20C



F16.21



F16. 22

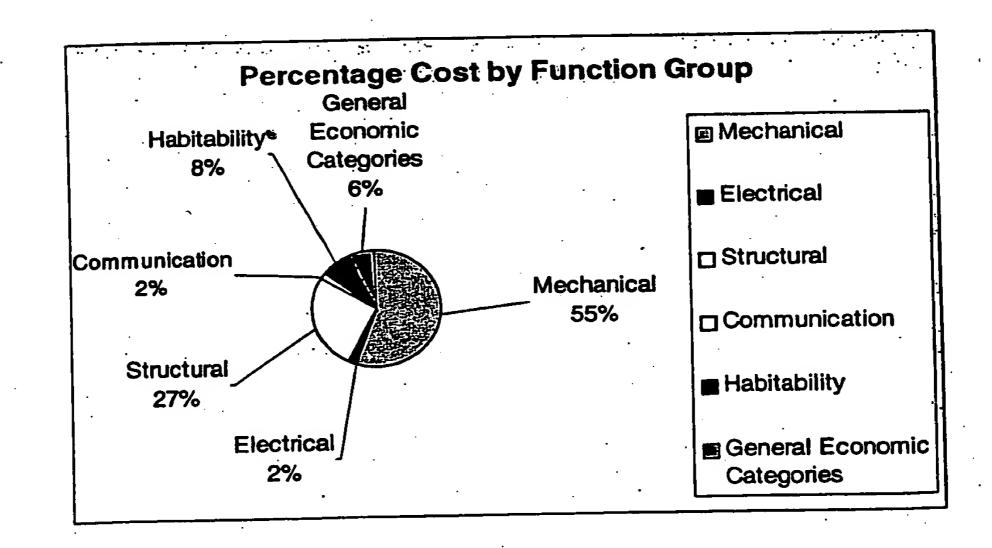


FIG. 23